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A STUDY IN TEACHER CHANGE

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Implementation of curriculum innovations requires that teachers have both knowledge of the change and commitment to use it. In order to determine what type of teacher is most likely to perceive and practice a curriculum innovation effectively, an in-service project was set up and studied. Nineteen elementary school teachers with varying degrees of teaching experience and previous preparation in science participated in the teacher education program developed for the new curriculum, "Science-- A Process Approach," sponsored by the Commission on Science Education of the American Association for the Advancement of Science. Correlation analysis of pre- and posttest scores and classroom observation yielded the conclusion that this in-service program was most successful for teachers with several years previous teaching experience but with few hours of previous science courses, suggesting that the longer a teacher has taught, the more receptive he is to new and fresh approaches to teaching and the more valuable such in-service programs are. A teacher's competency in science was found to effect positive change in the teacher's attitude toward and practice of the new curriculum, but the grade level taught appeared to be unrelated to attitude and curriculum changes. Correlation tables and a 14-item bibliography are included. (JS)

# A STUDY OF TEACHER CHANGE

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SCIENCE INSERVICE PROJECT
RESEARCH REPORT NO. 1

# A STUDY OF TEACHER CHANGE

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To implement a curriculum innovation requires that the user - the teacher - has both knowledge of change and commitment to use that change. It is also asserted that, if for both the knowledge of the curriculum innovation and the commitment for its use, the effective tone is positive, the innovation will actually become practice.

Securing such an effective tone is a challenge for teacher education.

A teacher education program has been developed for a curriculum innovation, Science - A Process Approach, sponsored by the Commission on Science Education of the American Association for the Advancement of Science. Some components of this program have been developed under the sponsorship of the Commission and other components have been developed through the Science Inservice Project of the Science Education Center at The University of Texas. This teacher education program has been designed to change the teacher's knowledge and commitment while

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enhancing the desirability of change. Modified or changed behaviors are perceived as desirable by the teacher if:

a. she becomes familiar with the innovation
b. she acquires experience so she knows what to expect from student's responses, and
c. she gains self confidence in working with the curriculum innovation.

Although the teacher education program includes opportunities for the teacher to participate in each of these three experiences, a key question remains to be answered: Does such a teacher education program result in observable changes in a teacher's perception of a curriculum innovation and in her subsequent practice of that innovation in her classroom?

Recognizing that the answer to any question involving complex human behavior is rarely a simple "Yes" or "No", the key question of this study can be extended by inquiring if the observable changes in teachers are related to specific experiences in a teacher's history. Ryans (1941) described this when he said:

> Successful teaching, as well as successful participation in most of the professional activities, is contributed to by many qualities of the individual, intellectual and personal. (Ryans, 1941, p. 5)

What in a teacher's past experience could contribute to the relative impact of a teacher education program?

Since teaching includes specific subject matter, the individual's past preparation in that subject matter area might logically determine the impact of an inservice program. Ryans, (1960, 1963) found special subject matter knowledge to be positively correlated with teaching effectiveness. Ellena (1961), however, found that subject matter competence was not a major factor in the quality of teaching performance. In an earlier study, Ryans (1951) reported that the amount of college training appeared to make little difference in effective teaching behavior. Is there a relationship between previous science training and the observable behavior change in a teacher who participates in a teacher education program? Will such a program be more effective with those teachers who have had a greater background in the subject matter area?

A second major component of the teacher education program is the involvement of the teacher with students. In the curriculum innovation, the focus of attention is on the student and how he learns. Thus the more teaching experience a teacher has, the more likely he would benefit from a teacher education program that emphasizes perceptiveness of student responses. However, the contribution of past teaching experience to changing teaching behavior is not clear.

In a very early study Knight (1922) analyzed the contribution of age, experience, and IQ to success in teaching. He concluded that none of these factors are closely related to successful teaching.

Shortly after, Bathurst (1929) showed that teacher efficiency increased slightly with experience but the increase was so slight as to be insignificant. In more recent times, however, Ryans (1960) did show an overall negative relationship between the amount of teaching experience and teaching effectiveness. He also found evidence of an increase in effectiveness with the early years. This finding seems to be supported by that of Ellena (1961) who concluded that teaching effectiveness seems to rise rapidly in the first years of teaching and then level off at a fairly stable plateau. Years of experience may be another key contributor to securing change.

Willower and Jones (1963) found that more experienced teachers generally held conservative views while less experienced teachers were more liberal and permissive. The more experienced teachers dominated the informal structure of the school and did not hesitate to communicate their point of view to less experienced teachers. They favored the status quo and opposed changes that were likely to result in a more permissive procedure.

In general the findings of research studies suggest that previous teaching experience of an individual is not related to change, in teaching behavior, especially after the first few years.

In an inservice program, the relevance of that experience to the grade level taught may be an important factor in determining how much the teacher benefits from a teacher education program. Ryans (1960) indicated however, that grade level taught was not a relevant variable

in teacher effectiveness. The contribution of grade level as a factor in the effectiveness of the teacher education program is not clear.

## PROBLEM

With what type of a teacher can a teacher education program be expected to produce the greatest change in both the perception of the innovation and the practice of the innovation? Four factors were selected to be studied as contributors to this perception of the innovation. They are:

1. Knowledge in the subject matter area - science competence.
2. Previous preparation in the subject matter area - college science courses.
3. Teacher experience with expecting and handling student responses.
4. Relevance of the teacher education program to the grade level taught.

## DESIGN

The teachers involved in this study were participants in the teacher education program of the Science Inservice Project. Each teacher received the same number of inservice sessions and was expected to use the curriculum innovation, Science - A Process Approach, in his classroom. The teacher education program has been described by Willson (1967) and Butts (1967) as one that involved the teacher in activities using the same teaching model the teachers were expected to use in their

classroom. The sample for the study included 19 teachers in a school of predominately middle class Anglo children. Table 1 summarizes the grade level distribution. The years of teaching experience of the group varied from 0 to 34 years with a mean of 11.2 years. The previous preparation in science varied from 0 to 30 semester hours with a mean of 13.6 hours.

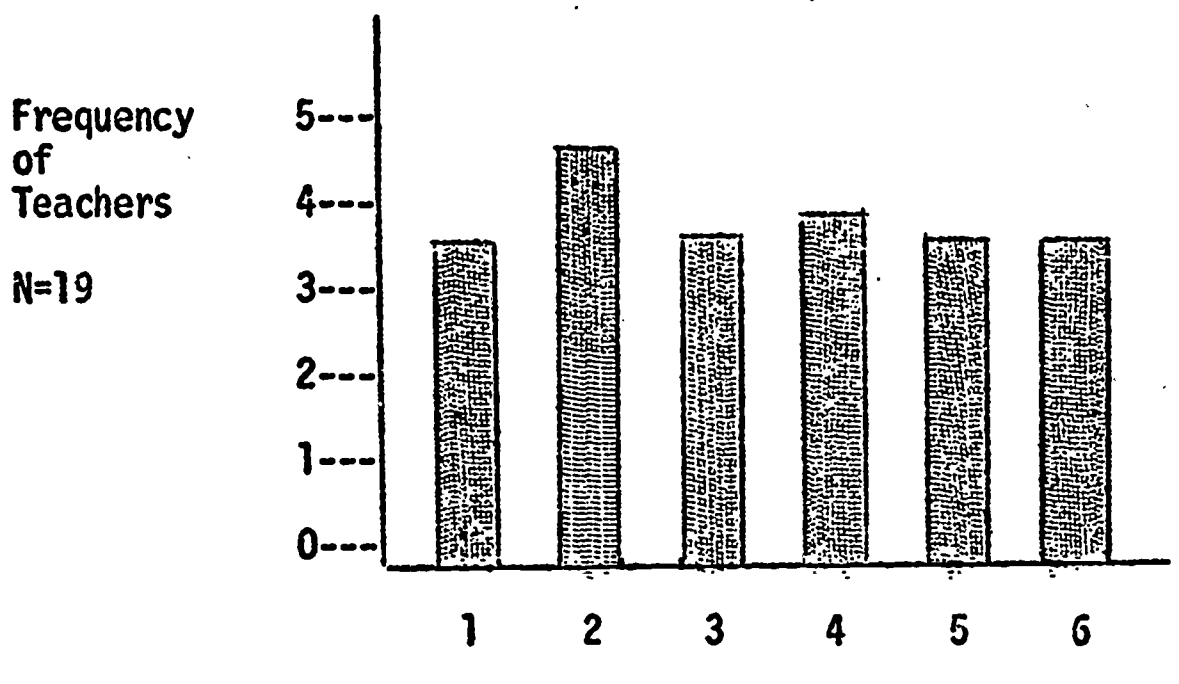
Before the teachers were involved in the teacher education program a pre-test battery was administered, and the first classroom observation was completed. During the inservice two additional classroom observations were made. Following the completion of the teacher education program a post-test battery was administered and the final classroom observation was made.

INSTRUMENTS USED

1. For the criterion variable of perception of the innovation a form of the Semantic Differential was used. The instrument is composed of twelve stimulus, or protocol words, each accompanied by the same twelve pairs of polar words. Responses are indicated on a seven point scale between polar pairs. Scores are expressed in terms of the factors of evaluation, potency, and activity.
2. For the criterion variable of the practice of the innovation, the Classroom Observation Rating Form (CORF), was used. This instrument is designed to gather quantitative

TABLE 1

DISTRIBUTION OF TEACHERS
BY GRADE LEVEL



data on what happens in the classroom. It is constructed in four categories:

1. Items related to teacher-student instruction and student behaviors.
2. Items related to teacher responses, actions, and planning.
3. Teacher characteristics.
4. Classroom environment.

Observations are restricted to 20 minute teaching sessions. (Ashley, 1967)

3. For the predictor variables of science hours, previous teaching experience, and grade level taught, biographical information was secured.
4. For the prediction variables of knowledge in science the Teacher Process Measure was used. This instrument consists of 26 items designed to assess science competencies of the teacher. (Commission on Science Education, 1967)

## ANALYSIS

Inter-correlations were obtained of science hours, teaching experience, grade level taught, and change scores in the Teacher Process Measure, Classroom Observation Rating Form, and the Semantic Differential. Inter-correlations were also obtained for the hours of science, years of teaching experience and grade level taught with the Classroom Observation Rating Form change scores.

## FINDINGS

1. Is a teacher's attitudinal change related to a change in science knowledge? Analysis of the correlations (Table 2) between change scores on the Semantic Differential and the Teacher Process Measure indicates:

   (a) that with an increase in science knowledge there is a corresponding decrease in the perception a teacher has of their involvement in the "active" phase of teaching science; and

   (b) that with an increase in science knowledge there is a corresponding increase in how the teacher views the value a community places on the science program.

2. Is a teacher's attitudinal change related to the amount of previous science training? Analysis of the inter-correlations (Table 2) between the change scores on the Semantic Differential and the number of hours of previous science courses indicates:

   (a) that with an increase in the number of hours in previous science courses there is a corresponding decrease in the teacher's perception of her science background and its impact

TABLE 2
CORRELATION BETWEEN TEACHER'S ATTITUDINAL CHANGE AND PREDICTOR VARIABLES N=19

| Semantic Differential | | Hours of Science | | Years of Experience | | Grade Level Taught | | Teacher's Knowledge of Science | |
|---|---|---|---|---|---|---|---|---|---|
| Protocol | Factor | R | Probability Level** | R | Probability Level** | R | Probability Level** | R | Probability Level** |
| Teaching | Potency | -.6534 | <.01 | | | | | | |
| Teaching | Activity | | | | | | | -.4719 | <.05 |
| Scientist | Potency | -.5790 | <.01 | | | | | | |
| Science - A Process Approach | Evaluation | | | .5878 | <.01 | | | | |
| Science - A Process Approach | Potency | -.4829 | <.05 | .6296 | <.01 | | | | |
| Science - A Process Approach | Activity | | | .4782 | <.05 | | | | |
| Library | Evaluation | .5674 | <.02 | | | | | | |
| Library | Potency | .5385 | <.02 | | | | | | |
| Principal's View of Science - A Process Approach | Evaluation | .5368 | <.02 | | | | | | |
| Town's Attitude toward Science - A Process Approach | Evaluation | | | | | | | .4797 | <.05 |

Note: Empty cells indicate no significant correlations observed.
** Two tailed T-test, Table V. A. Fisher, 1936

on: (1) her teaching; (2) her views of a scientist; and (3) her view of a curriculum innovation designed to increase her science competency.

(b) that with an increase in the number of hours in previous science courses there is a corresponding increase in the teacher's perception of the library relative to its value and impact in science, and also to her view of the worth the principal attaches to the curriculum innovation.

3. Is a teacher's attitudinal change related to her previous teaching experience? Analysis of the inter-correlations (Table 2) between the Semantic Differential and the grade level taught apparently has no relation to an attitudinal change in the teacher.

4. Is a teacher's attitudinal change related to the grade level taught? Analysis of the inter-correlations (Table 2) between the Semantic Differential and the grade level taught reveal no significant correlations. Grade level taught apparently has no relation to an attitudinal change in the teacher.

5. Is a change in a teacher's classroom practices related to the knowledge of science? Significant correlations were observed between a teacher's increase in science knowledge and the third observation and also on the composite of four observations. Correlations between the first, second, and fourth observations were not significant. Table 3 summarizes this data. It appears that there is less relationship between knowledge of science and classroom practice early in the school year than later.
6. Is a change in a teacher's classroom practices related to the amount of previous science courses, years of previous teaching experience, or to the grade level taught? Analysis of the inter-correlations between CORF observations and the variables of hours of science courses, years of teaching, and grade level taught revealed no significant correlations.

## CONCLUSIONS

When one examines the various correlations between change in the perception or attitude of the teacher and the variables of knowledge in science, previous course work in science, teaching experience and grade level, and relevance to the classroom it is interesting to observe the significant correlation between a teacher's knowledge of science and the change in perception toward the way the people of a community view Science - A Process Approach. May it be inferred that teachers

TABLE 3

CORRELATION BETWEEN TEACHER CLASSROOM PRACTICE AND KNOWLEDGE OF SCIENCE
N=19

| Classroom | Teacher's Knowledge of Science | Probability Level (Two-tailed Test-Table, V. A., Fisher, 1936) |
|---|---|---|
| 1st Observation | R = -.0500 | NS |
| 2nd Observation | R = .1998 | NS |
| 3rd Observation | R = .5924 | <.01 |
| 4th Observation | R = .4532 | NS |
| Composite of 4 Observations | R = .4961 | <.05 |

place more value on an innovative program because the patrons of the school desire it, thus providing reinforcement and security for the teacher in her classroom?

Significant but negative correlations of the teacher's knowledge of science with her perception of the "activity" of teaching suggests that the greater her knowledge of science the less involvement the teacher sees of herself as a teller of information. This may mean that as a teacher's proficiency in teaching this innovation increases, there is more student activity and involvement and a resultant decrease in teacher performed demonstrations and actively telling and doing for the students. It is possible to further infer that the act of teaching now becomes more that of a director and guide for student learning activities when involved in this particular curriculum innovation.

Course hours completed in science correlate significantly but negatively with a teacher's perception as she views the impact of the scientist and of the curriculum innovation. This may be interpreted as suggesting that the more college hours in science the teacher has completed the less she desired to teach science and the less positive is the image of a scientist. One could wonder if this is the result of what we commonly term the "traditional" course in science, that of the memorization and regurgitation of facts. Evidence from this study does not provide a well-defined answer to this question. With respect to the curriculum innovation, Science - A Process Approach, the teacher appears to be less critical of an innovative science curriculum if she had fewer formal courses in college science.

Course hours completed in science correlate significantly with the change in the teacher's perception of the principal's view of curriculum innovation. It appears that the more course hours the teacher has completed in science, the more value she places on the use of the library. Does this mean that, in her view, the active place of a student's learning about science, i. e., reading about science, is the library? If the teacher sees her building principal place a value on the curriculum innovation it may mean that a teacher with a greater number of hours in science feels more secure in teaching the innovative curriculum because of greater administrative support. This may also suggest that the teacher feels that the principal favors teachers with "number of hours in science" teaching the innovative curriculum.

The relationship between previous teaching experience and the observed change in the perception of teachers was observed to be significant only with respect to the teacher's perception of the curriculum innovation. This suggests that the longer a teacher has taught the more value she places on a curriculum innovation, the greater is its impact on her, and the more she sees herself being actively involved in it. This evidence may also be interpreted as suggesting that the longer a teacher has taught the more receptive she is to new and fresh approaches to teaching. This does not seem to agree with the conclusion of Willower and Jones (1963).

Evidence in this study suggests that the teacher's ability to cope with the science problems in the spirit of the curriculum innovation

improve with practice. This is evidenced by the change in the third classroom observation which correlates significantly with the teacher's knowledge of the science processes. Further support of this relationship is provided by the correlations of the composite scores of the classroom observations.

It is also observed that there is no evidence that course hours in science, years of teaching experience, or grade level taught have a relationship to the strategies for classroom practices in teaching science. This may suggest that classroom practice as employed in the approach of a curriculum innovation are indeed innovative. A further inference is that past training and experience have not included such practice.

## SUMMARY

Curriculum innovations have been developed by cooperative groups of academicians and educators. With these curriculum innovations have been developed parallel programs for teacher education. The question of this study has been: With what type of teacher can a teacher education program be expected to produce the greatest change in both perception of the innovation and the practice of the innovation? Analysis of related research indicated that some specific dimensions included competency in science, previous teaching experience, previous formal course work in science, and relevance of the teacher education program to classroom practice.

Results of the study indicate that those dimensions of the teacher's previous experience which are significantly related to a change in a teacher's perception of a curriculum innovation include her competency in science, her previous hours in science, and her previous teaching experience.

The study appears to suggest that a teacher education program can be expected to produce the greatest change in perception of the innovation with a teacher who has a number of years of teaching experience but who has few hours of previous science courses.

Further analysis indicated that the competency in science of a teacher affects change in the teacher's practice of a curriculum innovation.

Therefore, since the teacher's competence in science is a key objective of the teacher education program, and since it appears to be related to both the change in the teacher's perception and her practice of the curriculum innovation, to this extent the teacher education program appears to be successful.

It is also important to note that the change in practice occurs even though this is not related to grade level or previous teaching experience. This suggests that the teacher education program is directed toward a dimension of teaching that was not part of the teacher's previous frame of reference.

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